Biological Control Methods, expected growth over the next 15 years and the key factors impacting their adoption

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working with nature

the range of tools
What “Non-chemical alternatives” are available from the Biocontrol industry?

**Microbials**
- Viruses, Bacteria & Fungal Pathogens
  - Found naturally in soil, used in food, feed & and unregulated uses

**Macrobials**
- Predators, parasites & nematodes
- Living organisms found to naturally protect crops

**Semiochemicals**
- Pheromones, Plant volatiles
  - Communication tools found in nature with no killing effect

**Natural & Biochemical Products**
- Botanicals & Other Natural substances
- Products derived from nature

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**Regulated as PPPs**

**Not usually regulated as PPPs**
### Biological Market Overview

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**Introduction**

#### Biological Products

**Biofertilizers**
- Microbials used to enhance plant nutrient uptake from soil
- Nitrogen fixing bacteria make up largest group
- Others include mobilizers of specific nutrients (zinc, sulfur) and mycorrhizal fungi
- Biofertilizers regulated under country/state fertilizer regulations

**BioStimulants**
- Seaweed Extracts make up the largest segment in this group
- Microbials, primarily bacteria, often used as seed or soil treatment to aid in nutrient assimilation
- Organic acids are humic and fulvic acids used as soil amendments, formed by the microbial degradation of plant matter.
- Definition and regulation of biostimulants is still under development in most parts of the world

**Abiotic Stress Mgmt**
- N Fixing
- P2O5 Solubilizing
- Amino Acids
- Plant Extracts
- Organic Acids
- Seaweed Extracts

**Microbials**
- Bacteria; Fungi; Virus; Protozoa; Yeasts
- Bacteria, followed by Fungi make up the largest groups (>90%)
- Microbials are the largest market of biopesticides at US$1.3 Bn.
- Biggest challenges for microbials are formulation related: 1) Shelf life; 2) Stability; 3) Performance enhancement

**BioPesticides**
- Biopesticides are derived from natural materials, such as plants, bacteria and certain minerals. Biopesticides target specific pests and are inherently less toxic than synthetic pesticides.
- Biochemicals
- Plant Extracts; Semi-chemicals; Organic Acids
- Plant Extracts make up the largest segment in this group
- Semi-chemicals (pheromones) has the largest actual number of products
- Largest challenge for Plant Extracts is manufacturing and consistent quality in the active ingredient(s)

**Macroorganisms**
- Insects; Mites; Nematodes
- Insects followed by mites makeup the largest groups
- Unique in that the live organism in the form of eggs, larvae, pupae or adult is used.
- Most important challenge for Macros is logistics—shipping live organisms that have to have special care to survive
- Normally not classified as a Biopesticide—only as Biological Control Products

### Courtesy of Bill Dunham, Dunham & Trimmer as presented ABIM 2015
Where do biological inputs fit within or outside regulation?

Biopesticides
- Endophytes
- Biostimulants
- for biotic stress
- Mass trapping
- rna
- gm insects
- biosimilars

Biofertilisers
- Biostimulants
- Plant Strengtheners
- Soil Conditioners
- Probiotics
- Natural remedies
- Food & feed additives
- Food
Biopesticides – market, manufacturers and products

• **Biopesticide market**
  - Worldwide in 2014: $1.9 billion at user level; annual growth 15-20%

• **Biopesticide manufacturers**
  - Worldwide: approx. 230 (ex China, India)
  - Europe: 91
  - America’s: 98

  - IBCAs: 52
  - Microbials
  - Semio-chemicals: 171
  - Natural products

• **Total of biopesticide products:**
  - Macros: > 230 organisms
  - Micros, semiochems, naturals: > 450 actives, > 2300 products

Sources:
DunhamTrimmer, Biopesticide Industry Overview 2015
CPL, Biopesticides Worldwide Market 2013
Crop Protection of the future
Do we need to look at the problem differently?

“The law of the hammer” – Maslow & Kaplan

“If the only tool you have is a hammer everything looks like a nail”
Be innovative in bringing new tools to market, allow them access and use all of them wisely as per true IPM practice with traditional cultural practices, monitoring, intervention with bioprotection practices and where necessary chemical intervention!
Future Crop Protection: emphasis on prevention

- Resistant cultivars, developed via DNA and RNAi techniques
- Seed provided with endophytes: microorganisms for crop protection and growth stimulation
- Seed coated with biostimulants and biopesticides
- Use of natural/organic fertilisers
- Addition of ‘microbial community’ to soil or growing media
- Use of these methods in plant propagation phase
- Optimized growing conditions: fertilization, irrigation,
  - in protected crops: light, CO2, temperature, RH,
Future Crop Protection: results in:

→ Resilient plant from the start;

→ Optimal use of the plant’s ‘defense’ system

→ Resilient growing medium

→ Optimised control of growing conditions

→ Less need for intervention
Future Crop Protection: emphasis on monitoring

Occurrence of pests and diseases:

• Intensive monitoring by new methods:
  • Efficient automated traps for attracting insects with light, odours, pheromones, etc
  • Scouting for diseases and pests through use of odours released by disease-pest/plant combination
  • Continuous scouting via early odour detection robots and diagnostics → automatic reporting to farmer
• Remote sensing on weather, soil moisture, insects, nutrition, crop
• Knowledge database (ICT tool) → decision supporting tools → proposed intervention to farmer
Future Crop Protection: intervention

- Based on early detection → limited and minimal intervention
- Application via precision technologies and localised applications
- Application by agricultural robots: dispersion of beneficial insects, spraying, drenching, fertigation, dispersion of pheromones
- New techniques and means:
  - Extensive range of beneficial insects and mites available
  - Efficient beneficials with endo-symbionts
  - “Standing army” of natural enemies
  - Introduction of pests and diseases on a low level to trigger plant resilience &/or defence system
  - “Self-limiting” insect pests
  - Plant protection products based on or derived from natural substances, microorganisms, pheromones, RNAi, etc.
  - Mulifaceted Mass-trapping systems (attractants, lures, colour-odour combinations)
  - Increasing plant resilience by using elicitors, kairomones, etc.
  - Protected crops: climate and light settings to prevent and suppress pest and disease development
Future Crop protection: intelligent agriculture

- New tools based on computer technologies and devices
  - Use of sensors, remote sensing
  - Plant phenotyping, early warning
  - In field diagnostics
  - Data processing, large amounts of data
  - Instantaneous remote decision making
  - Application by intelligent equipment (robots, aerial, spot wise)
  - Precision application of plant protection products
  - Tracking and tracing in the chain
  - And more!
Future Crop protection

• Founded on prevention and monitoring
• Intervention only when needed
• New tools all nature-based solutions
• Biopesticides, biostimulants, biofertilisers
• Resilient soils and resilient plants (microorganisms, seed treatments)
• Automation, ICT tools and intelligent equipment minimise use of products and exposure
• Holistic approach
• Interventions upon a licensed PCA written recommendation
Use of bioprotection in a broader context

• Driving forces in pest management are many and varied, they continue to develop and change

• Macro factors: intergovernmental and governmental policy influences crop protection through legislation, funding of research and extension, environmental programmes, trading policies, biodiversity topics, etc.

• Major influences: legislation, environmental and food safety concerns, science and technology, and economics (the market)

• Several external factors limit or promote biocontrol, IPM and the use of biopesticides
Factors affecting adoption: Macro factors

- Political and societal needs favour the use of bioprotection (environment, biodiversity, food safety)
- Increased legislation of chemicals will stimulate development of alternative solutions
- Demand for sustainable agriculture is an opportunity for bioprotection
- The main driving force is the requirement of retailers and consumers for residue-free food !!!!
- The biocontrol industry has reached a sufficient level of maturity enabling solid growth in the near future
What other factors will affect adoption?

• Ensure proportionate seamless regulation
• Producing usable tools for farmers and advisors
• Adoption outside fresh produce in major agricultural crops
• Ensure global availability and adoption
  • Global federation of regional biocontrol associations
  • Harmonisation of regulation
  • Market access and use in all markets
• Communication of needs, solutions and knowledge with farmers and advisors
• Work effectively with all partners from farmers to consumers ensuring tools and research are fit for purpose
What does the future look like for the bioprotection industry?

- Bioprotection is becoming an essential part of IPM
- The Bioprotection industry will continue to grow
- The manufacturers landscape continues to change and grow
- The opportunities will increase, sales will grow
- Harmonisation in regulations is a must
- ABS is threatening new innovation
- Knowledge transfer to users is crucial to success
- Sustainable agriculture, IPM and bioprotection is the way forward
Bright future expectations for biopesticides

• Expected growth of biopesticides: 15-20% until 2020 to reach $ 6-7 bn
• source: many business consultants and market analysts
  (Agrow; CPL Business Consultants; Markets & Markets; MicroMarketMonitor; BCCResearch; Research and Markets; DunhamTrimmer)

• Similar growth rates as for biopesticides are expected for biostimulants, biofertilisers, agricultural inoculants, seed treatments

• Expected growth of pesticides 6-7% , to reach > $ 80 bn in 2019
  (Research and Markets)
Concluding remarks

Growth of biopesticide market

Growth areas:

• Microbials
  - Bacteria, for disease control, for nematode control
  - Antagonistic fungi, for disease control
  - Entomopathogenic fungi: slow growth
  - Baculoviruses: increased use in orchards and vegetables
  - EPNs: orchard, vegetables, amenity areas

• Semiochemicals & Natural Products
  - More specific niche solutions
  - Metabolites
  - Fermented products
  - Mixtures

• Annual growth will continue with 15-20%

• Bioprotection will become a major part of crop protection means: > 50% in 2030
Let's manage the transition in farming practice effectively!

Many thanks!

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